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NDBC Atmospherical and Oceanographic System Test Facility

Recently, the National Data Buoy Center (NDBC) established a new field facility to test various oceanographic and meteorological sensors/systems (Figure 1). At this facility, all the sensors and systems can be extensively tested in the field under natural environmental conditions. This article, which is an excerpt of an article presented at the Ocean Technology Conference at Stennis Space Center, in April 1997, briefly describes the facility.

The facility is at the eastern (offshore) end of the 561.1-m (613.6-yd) pier of the Field Research Facility of the U.S. Army Corps of Engineers' (COE) Coastal and Hydraulics Laboratory (CHL) in Duck, NC (Figure 2). NDBC, COE, and the Navy installed two side-by-side airtight environmental enclosures (each 6-m (20-ft) long, 3.3-m (10-ft) wide, and 2.4-m (8-ft) high used as control/storage rooms and laboratory space. The fiberglass enclosures are 12 m (40 ft) from the eastern end of the pier. The water depth at the location is about 7 m (23 ft). NDBC uses and maintains the western enclosure, while the eastern one is for the COE and the Navy (Figure 3).

Figure 4 shows an isometric view of the facility. The antenna, solar panels, and above-surface sensors can be installed on top of the enclosure or on the sensor tower. All the electronic control systems (sensor interface controllers, payloads, modem, PC, etc.) and batteries are kept in the control room. Remote data acquisition system, based on a Pentium 166 PC, was installed in the control room. This system acquires data using one or more of its several control and acquisition cards and transfers the data back to NDBC via phone line. With this remote connection, data files can be retrieved, system software can be updated, and recording parameters can be changed to suit NDBC's needs.

Besides the enclosure, the NDBC facility includes the following two structures that can support and mount various above-water and underwater sensors:

(1) a track/cart/arm assembly for underwater oceanographic sensors
(2) a 12.2-m (40-ft) sensor tower with a sensor swing arm for meteorological sensors and above-water oceanographic sensors

As shown in Figure 4, the sensor tower is at the northwestern corner of the NDBC enclosure. The 12.2-m (40-ft) Rohn® tower

Figure 1. The System Test Facility

consisting of four 3.3-m (10-ft) pre-fabricated sections has an equilateral triangular cross section. This cross section consists of 1 2-inch pipe made from high strength steel for the vertical side rails interconnected with 16-mm ($^{5}/_{8}$-inch) solid round bar for the "zigzag" patterned braces.
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Equatorial Buoy Deployed During *el Niño*

NDBC deployed a 3-m buoy on the equator at 154° W. longitude in October 1997. The new station is funded and directly supports the U.S. Sea Launch Co. for building a climatology database to support planned satellite launch operations from a floating platform in the equatorial Pacific. A description of the Sea Launch Project is provided in the October/November 1997 issue of *Launchspace* magazine.

Data from the new station are disseminated under World Meteorological Organization (WMO) identifier "51028." Sea Launch's first satellite launching is scheduled for fall 1998, after the NDBC buoy provides 1 year of detailed *in situ* measurements of the wind and sea conditions. The buoy will continue operating through the first year of Sea Launch's operational phase. By NDBC policy, all data will be available in real time to the sponsor, to the National Weather Service (NWS), and to the public through NDBC's home page **(http://www.ndbc.noaa.gov)**.
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A sensor swing arm, located 4.6 m (15.5 ft) from the top of the pier, was designed and fabricated by NDBC. The arm can be easily swung back toward the hut such that the sensors installed on the arm can be serviced by a technical staff on top of the hut. When the arm is swung out toward the north, the horizontal distance between the farthest point of the arm and the edge of the pier is 3.3 m (10 ft). Meteorological and above-water oceanographic sensors can be installed on the tower. Sensors that need to be installed in a way to avoid the unwanted effects from the pier (e.g., flow blockage due to the presence of the piles, shadowing effect) can be installed on the sensor swing arm.

NDBC designed and installed a track/cart/arm assembly on one pile at the pier (see Figure 4) to move the underwater sensors into and out of the water, alleviating the need of ship/divers, with no constraint on the sea condition. The tracks are made of fiberglass H-beams to reduce the weight of the structure. To reduce the potential marine growth on the track to minimize maintenance and ensure smooth movement of the cart, ultrahigh density polyethylene (UHMWPE) is applied to the inside track rails (where the cart moves).

Underwater sensors can be installed on the sensor arm or the hexagon sensor mount attached to the cart (Figure 5). The cart, which is attached to a set of track rails, can be winched up and down along the tracks. The sensor cables run through a hole in the top of the cart and then through 3.3-m (10-ft) long conduits installed between the two track rails. When the sensor cart is winched up (i.e., retrieval or service of the underwater sensors), the sensor cables and the conduits are also lifted. The conduits can then be temporarily removed from the track and laid on the working platform. The length of the sensor arm is 2 m (from the center of the hexagon sensor mount) with the lowest sampling depth of the sensor arm at 3.62 m (11.87 ft) below the mean water level.

To control various oceanographic sensors, NDBC designed an interface controller called the NDBC Oceanographic Sensor Interface Controller (NOSIC) and a corresponding time-series data recorder called a Mark II. The NOSIC interfaces consist of a payload, Global Positioning System (GPS) for more accurate clock and timing, Mark II recorder, terminal (PC), modem, system power source, and

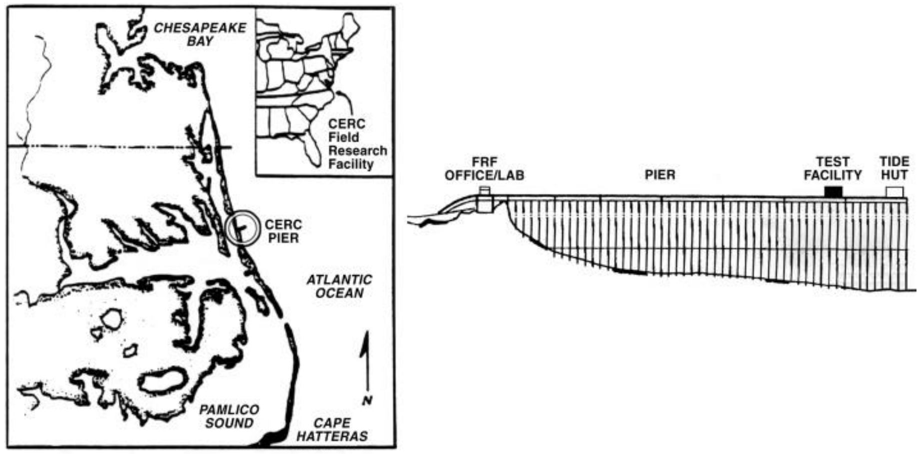

Figure 2. Location of the Test Facility on the Coastal Engineering Research Center (CERC) Pier

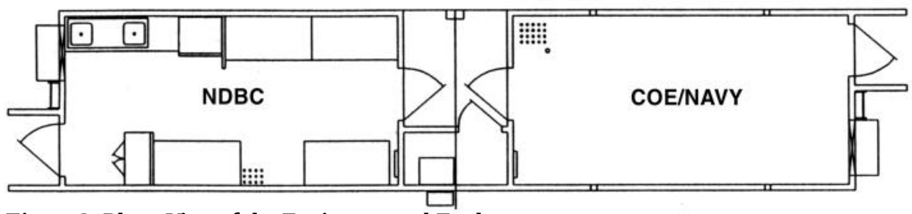

Figure 3. Plane View of the Environmental Enclosures

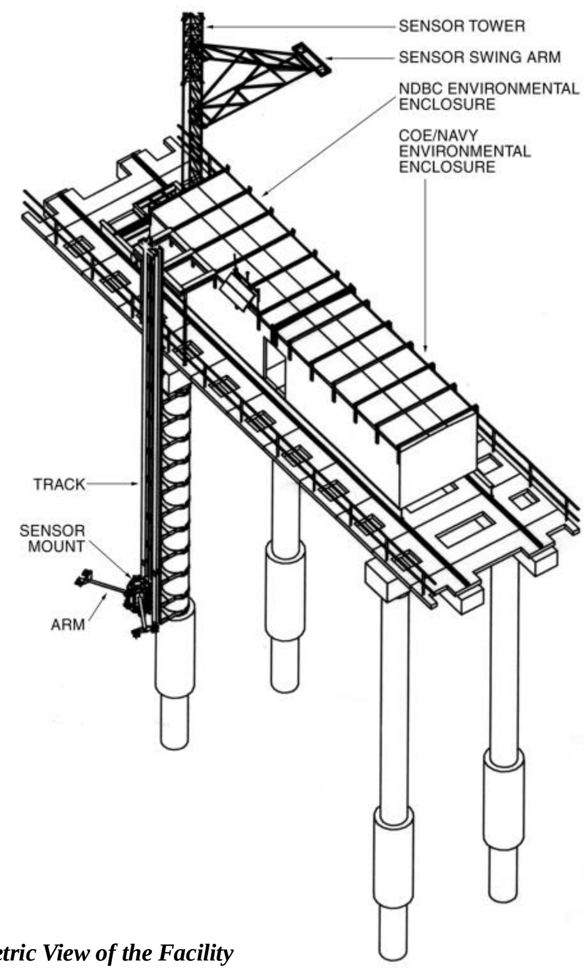

Figure 4. Isometric View of the Facility

oceanographic sensors. A NOSIC J-box provides wiring connections for sensors (Figure 6).

The NOSIC can interface up to 16 serial channels. Of these, 11 channels are used for sensors and 5 for system functions. Serial sensors interface to the NOSIC by an RS-485 link providing the capability to transmit data over long cable lengths. The nonsensor serial link (i.e., the GPS, payload, modem, Mark II, and the terminal) uses RS-232 for their communication. The only analog measurements the NOSIC makes are the system battery voltage and charging current. Currently, the NOSIC will not measure any analog sensors. However, analog signal conditioning circuitry can be added to the NOSIC if needed.

With the current configuration of the NOSIC, the data from the sensors are accumulated at a maximum sampling rate of 6 Hz for 3 minutes. At the end of the 3-minute period, the data are processed providing the mean and standard deviation for each measurement. The processed results are formatted for transmission to the desired payload when a polling character is received from that payload. The payload includes the data in its hourly Geostationary Operational Environmental Satellite (GOES) message. Besides the NOSIC-processed data, the 3-minute raw data are also stored on a Mark II recorder for later retrieval.

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Figure 5. Track/Cart/Arm Assembly

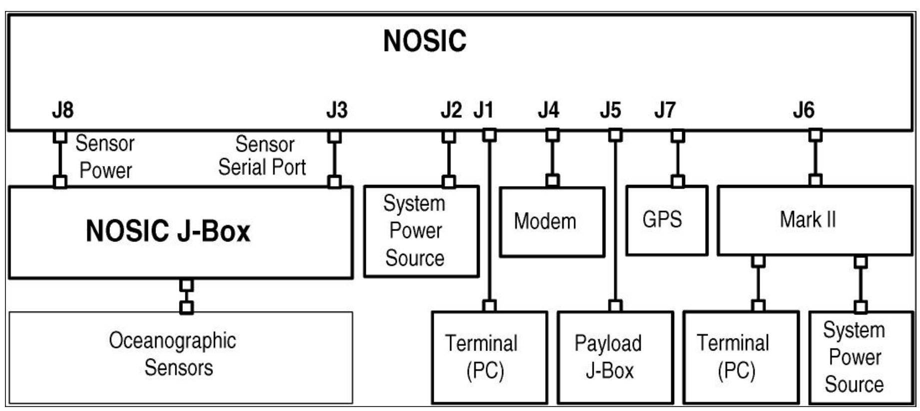

Figure 6. System Diagram of the NOSIC System

The purpose of this Bulletin is to inform persons involved in automated acquisition or use of environmental data, at sea and on land, as to the systems under development or in use, primarily by NOAA, that perform that function. Relevant articles are encouraged from non-NOAA sources. Subject matter should be current and in the general style illustrated by articles in this issue. Photographs must be 8- by 10-inch black and white prints. The right to edit all submissions is reserved. Articles ready for publication should be submitted to the:

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